

parts with more and more *Lympha* daily.

13. The great instrument of the circulation of the blood is the *Systole*, or vibration of the heart, which yet would not be sufficient from hindring the coagulation of the blood, without a continual supply of *Lympha* to dilute it.

An Exact Account of the Three late Conjunctions of Saturn and Jupiter, (within the space or less than seven months according to accurate Observations) viz. Octob. 14. 82, &c. Together with an Account of what other Conjunctions of them there happened for more than 100: years last; beginning at the year 1563: And a Table Computed whereby to make an Estimate of what other Conjunctions have happened for the time past, or that will happen for the time to come. All by J. F. Astron. Reg. & R. S. S.

WHilst the Common People have admired to see the two Superior Planets *Sa'urn* and *Jupiter* continue so near each other the whole year, and our Astrologers have affrighted them with fearful Predictions of direful events to succede this appearance, the
more

more Judicious are desirous to know how often and at what time their Conjunctions happen, that by comparing their Tables of these Planets Motions with the observed appearance, they may be the better able to correct them and render them more agreeable to the Heavens. Examining our Ancient Ephemerides I do not find that Three Conjunctions of *Saturn* and *Jupiter* have ever happened in one years space, since they were first in use to this present. Those of *Moletius* Calculated from the Alphonsine Tables indeed make three in the space of Eight Months betwixt *August* 1563. and *April* 1564 inclusive. But the Ephemerides of *Stadius* Calculated from the *Prutenick*, make onely one, on the 26 of *August* of which *Junctinus* gives us the following Observation in the Preface to his Astronomical Tables. Anno 1563. Augusti 24. hora 14. 30 post Meridiem Aurangæ, Jupiter à parte septentrionis cooperiebat quasi Saturnum, qui erat à parte Meridionali, utraque autem harum Stellarum, in fine 28 gradus Cancrì deprehendebatur, Riccioli hence concludes that the Planet *Jupiter* covered some part of *Saturn* at this time. But without reason, for the words *quasi cooperiebat* intimate not that the one did corporally cover the other, but rather that there was some small Interval betwixt them. The *Caroline* tables make the visible latitude of *Saturne* now 11' 45", of *Jupiter* 26 10' both North, the Conjunction being some few dayes past: but because their latitudes alter slowly we may hence conclude the difference 8' 25' to have been nearly their distance at that time, these Tables being grounded on the *Tychonick* observations made within less than 40 years after, and shewing the Latitudes of the Planets well at this time near 100 years later we may conclude to have answered them as well then; and if we consider how small a space the distance of 8½ minutes appear to the naked eye in the Heavens, especially betwixt two such bright Planets as *Saturn* and *Jupiter* are, that the *Caroline* distance agrees very well with the words of *Juncti-*

Conjunction in
fine D 1563

mus and that *Riccioli* was grossly mistaken.

1583.

Their next Conjunction according to *Maginus* s Ephemerides founded on the Prutenick numbers, was *April 29. 1583.* in 21. deg. of κ , the Sun being then in 17. deg. of ϑ so that the Planets rising before him in signes of short ascention and with South Latitude this congress could not be observed by the noble *Tycho* who was mindful of it as appears by this note in pag. 55. of his *Historia Cœlestis. May 30. A. M. quo primum post Conjunctionem Saturnum vidimus, capte sunt distantie inter Jovem & Saturnum per Radium.*

	<i>b</i>	<i>i</i>	<i>o</i>	<i>i</i>
hora	1	47	3	24
	1	50	3	24

1603.

The same Ephemerides shew the next Conjunction of *Saturn* and *Jupiter* 1603. *Dec. 14.* at noone, in $9^{\circ} 36'$ of κ but the Ingenious *Kepler* and our Sr. *Christopher Heydon* found it by observation seven days sooner, or the Seventh day of the same month in the Morning, in near Eight degrees of κ the Planets being then but newly emerged from the Rayes of the Sun.

1623.

The Ephemerides of the Learned *Kepler* Calculated from his own *Rudolphine Tables* make the next Conjunction 1623 betwixt the 7th and 8th of *July*, in $6^{\circ} 46'$ of ϱ , the Planet *Saturn* being then only 4 minutes to the North of *Jupiter*, but this first Conjunction in the fiery Trigon hapning under the Suns beams was not observable.

1643.

By the same Tables, and Ephemerides of *Eichstade* Calculated from them, these Planets met again in the 25th degree of κ , betwixt the 15th and 16th of *Feb. 1643*, with a degree difference of Latitude.

1663.

By the joynt consent of *Eichstades* and our *Wings* Ephemerides the same Planets were in Conjunction again, 1663 on the 10th of *October* at Noone in $13^{\circ} 30'$ of κ with one degree difference of Latitude, this Conjunction was observable

servable after Sun-set in our Latitude, but I hear not that any one observed it.

In every of these years there happened only one Conjunction of the two Superiors, nor is it possible that there should be more except the Heliocentrical Conjunction fall near the Opposition of the Sun; for then there may be Three, Two Direct, and One Retrograde, as has been within the space of Seven Months, betwixt *October* and *May* last inclusive, of which the true times are determined from the following Observations.

1682. *b.* 1
Octob. 5. 17. 51. betwixt the Centers of *Sat.* & *Jup.* 34 54.
 54 *rep.* 34 48.

12	13. ^h 49'. betwixt their Centers	16	02
	54.	rep.	16 04
14	03. Betwixt their next limbs	15	22

17.	14	10. Betwixt their Centers	20	09.
		17.	rep.	20 12.
		21.	again	20 14.
		25 Betwixt their next limbs	19	44.
14		33. Betwixt their remoter limbs	20	37.
			0	1 "
15		09. <i>Saturn</i> from the heel of <i>Castor</i>	48	32 25.
		14. <i>Jupiter</i> from the same Star	48	45 05.
		17.	rep.	48 45 20.
		20. <i>Saturn</i> from the same Star again	48	32 20.
		50. Betwixt their Centers again		20 30.

19 15	41. Betwixt their remote limbs	26 02 ^v
	45. Their Centers	25 37 ^v
	47. Their next limbs	25 11.

22.18.	25. Betwixt their Centers	33 19'
	29.	rep. 33 26.

The distances betwixt the Planets were measured with the Micrometer and sixteen foot Glafs, from the fixed Stars with the Sextant : those of the twelfth day by my assistant, my self being then very ill of the Stone, the rest by my self : I took no distances on the seventeenth day for determining their Latitudes not being well able to abide longer in the cold Air : these if requisite may be borrowed for present use from the *Caroline* tables, which by continual observations and experience I find not very much erroneous in the Latitudes of the Planets.

On the 22 day the Planet *Jupiter* was in consequence of *Saturn* something less distant from him then he had been observed on the fifth day near the same hour. Hence the middle time betwixt these observations is pointed out for the time of their true Conjunction, but to determine it more accurately I shall examine the observations made with the Sextant on the seventeenth day which being nearest the time are most proper for this purpose.

The correct Longitude of the Heel of *Castor* is now \odot $00^{\circ} 50' 42''$ its Latitude $51^{\circ} 40''$ South. The Latitude of *Saturn* by the *Caroline* tables $56^{\circ} 20''$ of *Jupiter* $41^{\circ} 30''$ both North.

By the assumed Latitude of *Saturn* $56^{\circ} 20''$ and his distance from the Heel of *Castor* observed and corrected $48^{\circ} 32' 30''$. I find their difference of Longitude $48^{\circ} 30' 37''$ therefore *Saturn* in *Leo* $19^{\circ} 21' 19''$.

By the Latitude of *Jupiter* assumed $41^{\circ} 30''$ and his distance from the Star $48^{\circ} 45' 20''$: their difference of Longitude $48^{\circ} 43' 56''$ and *Jupiter's* place in *Leo*, $19^{\circ} 34' 39''$.

Hence *Jupiter's* place in Consequence of *Saturn's* $13^{\circ} 20''$ with which and the distance of their centers observed the same night $20' 12''$, I find the true difference of their Latitudes $15^{\circ} 20''$ but half a Minute different from what I assumed it on the Authority of the Tables.

The apparent motion of *Jupiter* from the fourteenth to the

(250)

January the 26 both the Planets being in \odot to the Sun

b	i		i	''
26.	6.	03 betwixt their Centers		15 08.
	7		rep.	15. 06.
7	00	Betwixt their remote limbs		15 31.
	8	By T. Smith	rep.	15 29.
	12	Betwixt their Centers		15 05.
	14		rep.	15 02.
	17	Betwixt their next limbs		14 29.
	20		rep.	14 31.
	21		again	14 26.
9	24	Jupiter from the heel of Castor		46 18 10.
	26		rep.	46 18 05.
	28	Saturn from the said heel		46 08 50.
	30		rep.	46 08 55.
	37	Jupiter from the bright Star } of the Lions Head ϵ		8 42 05
	39		rep.	8 42 05.
	40 $\frac{1}{2}$	Saturn from the same Star		8 29 35.
	42 $\frac{1}{2}$		rep.	8 29 40.
	48	Jupiter from the Lions Heart		8 18 00.
	50		rep.	8 17 55.
	52	Saturn from the same		8 29 35.
	54		rep.	8 29 35.
	59	The Lions Heart from E in the Head		12 58 50.
10	03	The heel of Castor from the Lions Heart		54 34 20.
	8 $\frac{1}{2}$	The heel of Castor from E Ω		46 24 45.

Which last Three Distances are exactly the same I had measured them on the 24. at night.

b	i		i	''
Jan. 30.	5.	28 Betwixt their Centers		11 36.
	30		rep.	11 33.
	34	Betwixt their remote limbs		11 58.
	36		rep.	12 01.
	38	Betwixt their next limbs		11 01.
5.	41		rep.	11 00.

Feb. 7. 7. 37 betwixt their Centers 28 35.
40 rep. 28 34.
The

The distances of the two Planets from each other as also from the fixed Stars were taken at other intermediate times betwixt these, as often as the Clouds and ill weather of the season would permit, but I transcribe them not, esteeming these sufficient for my purpose, which is to shew the true times of their apparent Conjunctions with their visible places then.

From observations formerly made, I have determined the true places and Latitudes to this present time of

	s	o	'	"		o	'	"
The Heel of <i>Castor</i> .	♌	0	51	10.	Lat.	0	51	40 South.
Bright * in the Lions head.	♌	16	15	27		9	41	07 North.
Lions Heart.		Leo	25	24 45		0	26	20 North.

And from the above recited Measures, the true distances of the Planets from these Stars *January* the 26th. at 5^h 40' p. m. as follows.

	o	'	"
<i>Saturn</i> from the Heel of <i>Castor</i> .	46	09	00
<i>Jupiter</i> from the same.	46	18	10
<i>Saturn</i> from the Lions Heart.	8	29	40
<i>Jupiter</i> from the same.	8	18	00
<i>Saturn</i> from the bright * in the Lions head.	8	29	40
<i>Jupiter</i> from the same	8	42	10

Whence I collect the true places at this time.

	s	o	'	"		o	'	"
Of <i>Saturn</i> .	♌	16	57	10.	Latitude.	1	13	10.
Of <i>Jupiter</i> .	♌	17	07	10.	Latitude.	1	01	30.
Difference. of Longitude.		10	00.		of Latitude.	11	40.	

The Retrograde motion of *Jupiter* from *Saturn* in four days, betwixt the twenty sixth and thirtieth of this Month, by my correct Ephemeris is 12^h 15^m If say therefore as 12^h 15^m is to four days or 96 hours; so is 10^h 00^m the difference of the Planets present Longitudes to 78 hours or three days six hours, which therefore added to the time of that observation *January* the 26^d 9^h $\frac{2}{3}$ gives the true time of the

Con-

8 Jan 29. 16. hours after noon or according to the common account *January* the 30. at Four a Clock in the Morning

At which time both the Planets are in Ω 16. 41. $\frac{1}{2}$ with 11 $\frac{1}{2}$ min. difference of Latitude or Distance from each other. Which is further confirmed by the measured distances of the Planets on the 30 at night before recited.

On the 26. day at 9^h 40ⁱ the suns true place was by my Tables in \approx 17° 21' $\frac{1}{2}$ so that He was now about $\frac{1}{3}$ of a degree past their opposition.

Towards the latter end of the following *April* the Planet *Jupiter* began to approach *Saturn* again both being now direct & the Twenty Eighth at night with the Sixteen foot glass and micrometer I measured the distances

<i>h</i>		<i>l</i>		<i>l</i>		<i>l</i>	
<i>April</i>	28.	10	21	Between their Centers		0	32 35
			23			rep.	32 33
			24	Between their next limbs			32 04
			26			rep.	32 02
	10	29		Between their remote limbs			33 22
This last not accurate, Clouds interposing							
<i>May</i>	7	8	59	<i>Jupiter</i> from the Lions Heart		10	59 00
		9	01			rep.	10 59 00
			3 $\frac{1}{2}$	<i>Saturn</i> from the Lions heart		10	58 50
			5			rep.	10 58 50
			11	<i>Jupiter</i> from E in the Lions head		8	55 35
			15			rep.	8 55 40
			17	<i>Saturn</i> from the same Star		8	39 40
			18			rep.	8 39 40
<i>With the Micrometer</i>							
			30	Between their Centers		15	38
			33			rep.	15 37
			35	Between their next limbs			15 03
			36			rep.	15 00
			40	Between their remote limbs			16 02
			42			rep.	15 58
<i>With the Sextant again</i>							
	10	20		<i>Jupiter</i> from B in Ω		38	11 45
							23

23		rep. 38 11 4
26	<i>Saturn</i> from the same Star	38 10 55
28		38 10 45
<i>Ma</i> 11 9 ^h	28' Betwixt their Centers	20' 02"
31		rep. 20 02
16 9 22	Betwixt their Centers	dub. 34 04

From these Observations I state the Distances of the Planets from the fixed Stars *May* the Seventh at 9^h 5ⁱ P. M. as follows.

<i>Saturn</i> from the Lyons heart	10 58 50
<i>Jupiter</i> from the same	10 59 00
<i>Saturn</i> from ϵ in the Lyons head	8 39 40
<i>Jupiter</i> from the same	8 55 35
Hence the true Longitude of <i>Sat.</i> Ω 14° 27' 42" Lat. 1° 12' 46" North	
of <i>Jupiter</i> Ω 14 26 37 Lat. 0 56 43 North	
Difference of Longitude	1 04 Lat. 16 03

The Difference of Latitudes something exceeds the Distance measured with the Micrometer, by reason that the Wind then shaking the Sextant permitted us not to be so exact as usually, but the difference, being less than half a minute, I esteem inconsiderable.

The diurnal motion of *Jupiter* from *Saturn* was now 3' 15", it holds therefore as 3' 15" one days motion, is : to one day or Twenty Four hours : so 1' 04" the Distance of *Jupiter* from the δ with *Saturn* to Eight hours, the interval betwixt the observation and following Conjunction, which was therefore 17^h after Noon, or according to the vulgar reckoning, *May* the Eighth at Five a Clock in the Morning.

At which time the true place of the Planets is Ω 14° 28' $\frac{1}{2}$ the difference of their Latitudes 15' 40" *Saturn* being so much more Northerly than *Jupiter*

In all or best esteemed Astronomical Tables extant the mean motions of the Planet *Saturn* are too swift, of *Jupiter* too slow

considerably, hence it came to pass that they made the direct Conjunctions some days later, the Retrograde earlier than they were found by observation.

Argolus gives the first Conjunction *October* the Twentieth at Noon, in Ω $19^{\circ} 55'$ above six days later and 48 min. forwarder in the Ecliptick than it appeared. The second *January* the Nineteenth at Midnight in Ω $17^{\circ} 56'$ above ten days earlier than it was observed, and $1\frac{1}{2}$ deg. short of its true place in the Ecliptick. The last Conjunction he hath *May* the Sixteenth in the Evening in Ω $13^{\circ} 35'$ Nine days later than it really was, and in above 1 deg. less Longitude.

By <i>Keplers</i> Rudolphine Tables <i>January</i> 26	<i>h</i>	<i>'</i>
The place of <i>Saturn</i> is Ω $17^{\circ} 21' 10''$ his Latitude $1^{\circ} 11' 18''$ N	9	40
but was observed Ω $16^{\circ} 57' 10''$ his Latitude $1^{\circ} 13' 10''$		
Difference	24	52
The place of <i>Jupiter</i> Ω $16^{\circ} 51' 29''$ Latitude $1^{\circ} 04' 28''$		
observed Ω $17^{\circ} 07' 10''$	1	01
Difference	15	41

The Errors of the Caroline and British Tables of our Countrymen are somewhat less than these, but other Tables generally differ more, as those that are desirous to be informed will find by comparing their own Calculations with the Observations before recited.

Riccioli in the Second part of the first Tome of his *Almagest*, has given us a Table of all the mean Conjunctions of the Two Superiors from the Creation to the year of Christ 2358. but very Couise and incorrect. I have therefore made a New one for 43 Revolutions which are Completed 853 Julian Years, and 235 days from their correct mean Motions. This being the Period of the greatest Conjunctions after which space of time they return to the same place of the Zodiack within $\frac{1}{2}$ of a degree.

The Ordinary Conjunctions happen once in Twenty Years or more precisely in 19. Julian Years and 312. days, in which
time

time *Saturns* mean motion is $8^{\circ} 02' 48'' \frac{1}{3}$, *Jupiter's* the same above one Revolution.

These are commonly termed the Lesser of the great Conjunctions, which continue in Signs of the same Triplicity for 10. Revolutions to each other or 198 Years: each Conjunction according to the mean Motions being $8^{\circ} 02' 48'' \frac{1}{3}$ removed from the Preceding, so that if any Conjunction was made upon the first point of γ the next following shall be in $10^{\circ} 48'$ of α and all the following for 198 years shall fall in γ α and α , signs of the same Triplicity.

But the Eleventh Conjunction after shall happen in the first degree of ♌ and the following ten Conjunctions in 8° ♌ and ♍ , Signs of the same Triplicity. Of these the First is called by our Astrologers the Greater Conjunction.

But the greatest is, when after 43 Conjunctions completed in 853 years 235 days, the mean Conjunctions having been made in all the signs return to that point of the *Ecliptick* from whence they began: tho I must confess had I been to name them I should have called those the *Greatest* which happen in the signs ♌ and α because then the Planets rise highest, and are longest visible in our Horizon, as also being near their North Nodes, they approach nearest, and if they have any extraordinary influence (which *Naboyd* thinks either they have not, or if they have, we understand not) it must according to their Axiomes be strongest.

Those which happen in ♍ and ♎ I should call the *Greater* or *Middle*, because the Planets being then near their South Nodes, may approach each other again very nearly tho they rise not high in our Horizon, being in Southern signs; the rest might be accounted the *Lesser* or *Ordinary*.

The mean Conjunction of *Saturn* and *Jupiter* this year 1683. was on the Fourteenth day of *January* old stile at 12 hours after Noon in the Meridian of *London*, at which time the mean motions of both the Planets were $4^{\circ} 11' 45''$

this may be the Radix for the Following Table.

By which to find the time of any mean Conjunction past or future nearest to any place of the Zodiack *For times past*, subtract the Longitude of the given place from the Longitude of the Radix $4^{\circ} 11' 45''$ the residue seek in the last Column of the Table; if you find not the precise number take the next to it, against this you have in the second Column the years and days, and in the first the number of Conjunctions past since any was made in that place. Subtract the years and days from 1683 *January* the Fourteenth and the motion from $4^{\circ} 11' 15''$ so have you the true time of the mean Conjunction, and Longitudes of the Planets then.

But *For Times to come* Subtract the Radix from the given place; seek the Residue as before in the last Column; if you find it not, take that you find nearest its against which, as before, you have in the second Column, the years and days; in the first, the Revolutions future, for Example.

If it were required to know when the last Conjunction in the first degree of \approx Subtracting \approx or Ten signs from $4^{\circ} 11' 15''$ the residue is $6^{\circ} 11' 15''$ which seeking I cannot find in the Third Column of the Table, but I find $6^{\circ} 12' 56''$ which is not two degrees more, and against them 516. years 57 days, and in the first Column 26. for the number of Conjunctions interlapsed. Subtracting 516 years 57. days from 1683 *Jan.* 14. there remains 1166 years 322. days, which shews me that the Conjunction was in the year 1166 *Nov.* 18. and Subtracting the motion $6^{\circ} 12' 56''$ from $4^{\circ} 11' 45''$ it points me to the place in $9, 28^{\circ} 49''$.

Or if the time of the first Conjunction in \approx to come were demanded. I subtract the Radix $4^{\circ} 11' 45''$ from Six Signs the residue $1^{\circ} 17' 15''$ I seek in the Table but find it not, I take therefore the next to it $1^{\circ} 20' 29''$ the next to it against which stands 357 years 124 days these added to 1683 *January* 14 give me the year 2040 and 133 days *May* the 13 for the time of this Conjunction and adding the

the $1^s 20' 29''$ to the Radix $4^s 11' 45''$ it makes $6^s 02' 14''$ for the true mean Longitude of this Conjunction.

From the mean Conjunction the Apparent may be found by the help of Planetary Instrument, or the usual Astronomical Tables; but the method I leave to the Judgment of the Skilful Artift, onely advifeing him that in ftateing thefe Conjunctions I have not made ufe of any extant Tables, but of fuch Numbers as I have corrected by very late Observations compared with the Ancient.

J. F.

The Observatory

July 25.

1683.

A Table

A Table of the mean Conjunctions of Saturn and Jupiter with their Intervalls in time and Motion.

<i>Intervals.</i>				<i>Intervals.</i>			
Revo- lutions cōplete.	Years	daies.	Motion.	Revo- lution cōplete.	Years	daies.	Motion.
			s o /				s o /
1	19.	312	6. 02. 48	25	496.	111	10. 10. 08
2	39.	258	4. 05. 37	26	516.	57	0. 12. 56
3	59.	204	0. 08. 25	27	536.	3	2. 15. 44
4	79.	150	6. 11. 13	28	555.	315	10. 18. 32
5	99.	096	4. 14. 01	29	575.	261	6. 21. 21
6	119.	42	0. 16. 50	30	595.	207	2. 24. 09
7	138.	35	3. 19. 38	31	615.	153	10. 26. 57
8	158.	299	4. 22. 26	32	635.	99	6. 29. 45
9	178.	245	0. 25. 15	33	655.	45	3. 02. 34
10	198.	191	3. 28. 03	34	674.	35	1. 05. 22
11	218.	137	5. 00. 51	35	694.	302	7. 08. 10
12	238.	83	1. 03. 40	36	714.	248	. 10. 59
13	258.	29	9. 06. 28	37	734.	194	11. 13. 47
14	277.	340	5. 09. 16	38	754.	140	7. 16. 35
15	297.	286	1. 12. 04	39	774.	86	3. 19. 24
16	317.	22	9. 14. 52	40	794.	3	1. 22. 12
17	337.	178	1. 17. 41	41	813.	342	7. 25. 00
18	357.	124	1. 20. 29	42	833.	289	3. 27. 49
19	377.	70	2. 23. 18	43	853.	235	0. 00. 37
20	397.	16	5. 26. 06				
21	416.	327	1. 28. 54				
22	436.	273	10. 01. 43				
23	456.	219	5. 04. 31				
24	476.	165	0. 07. 19				